DANA BICKFORD.

Knitting-Machine.

No. 162,886. Patented May 4, 1875.

Fig. 1.

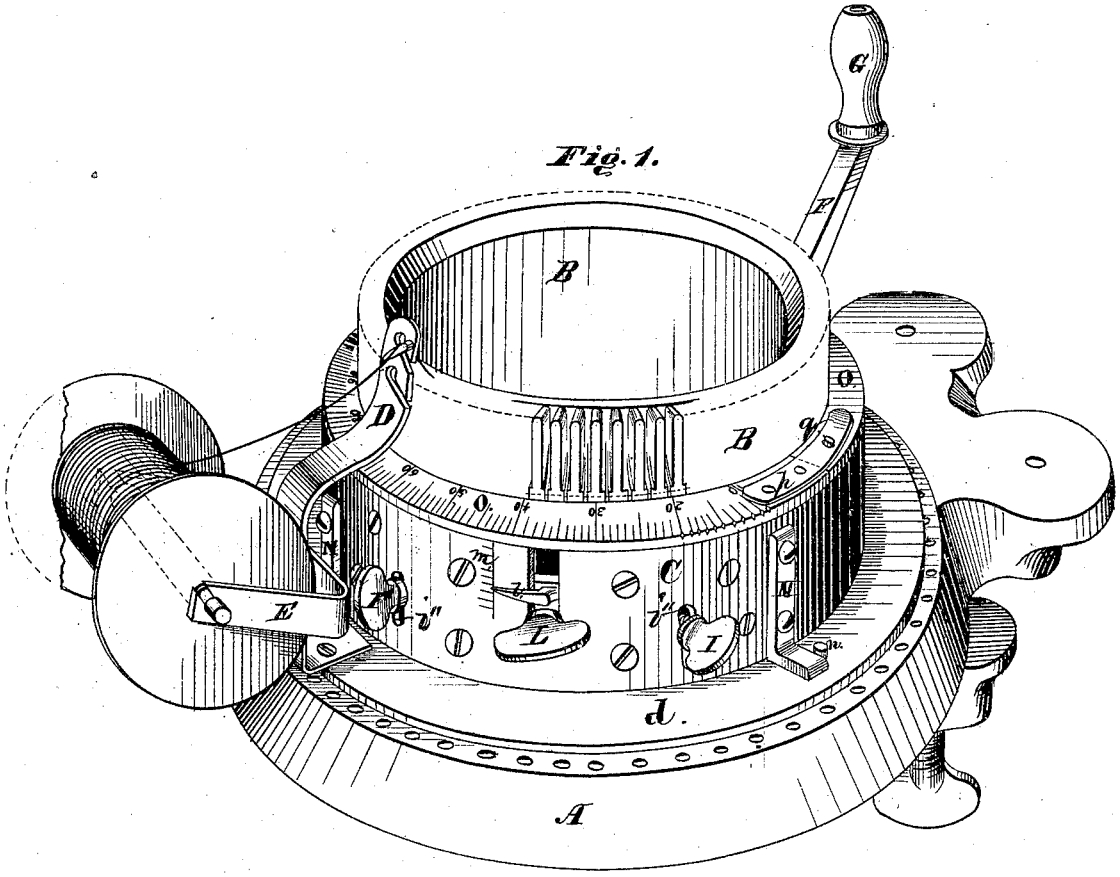
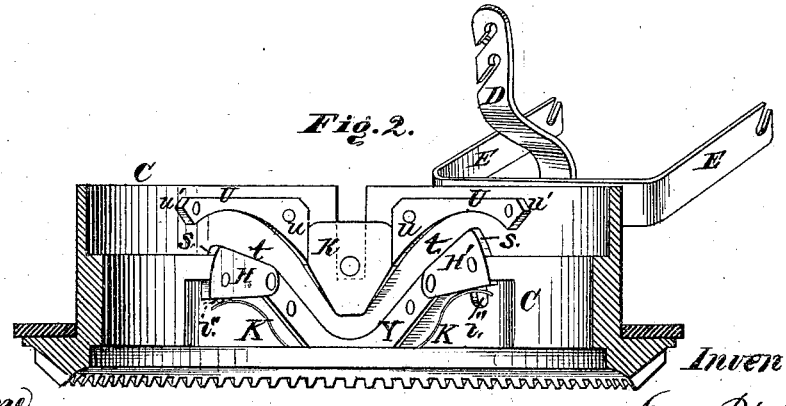



Fig. 2.




Witnesses.

H. L. Perine.

W. Bradford.

Inventor.

Dana Bickford,

by John J. Halsted.

his Attorney.

# UNITED STATES PATENT OFFICE.

DANA BICKFORD, OF NEW YORK, N. Y.

## IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. **162,886**, dated May 4, 1875; application filed March 6, 1874.

*To all whom it may concern:*

Be it known that I, DANA BICKFORD, of the city, county, and State of New York, have invented an Improved Family Knitting-Machine; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

Figure 1 is a perspective view of a Bickford family knitting-machine with my present improvements thereon. Fig. 2 is a vertical section, showing my novelties in the construction of the cam and cam-switches.

My present improvements consist in the employment of wing cams or switches in combination with a draw-down cam and the needle-cylinder—these wing-cams being operated by the butts of the needles, by friction between them and the needle-cylinder, or by springs; in so locating the switch-cams that they are adapted to rise and fall at their outer ends; in combining with the rotary cylinder a driving-handle and a bobbin or spool frame or stand which shall run coincidently with it and with the thread-guide, and in other particulars hereinafter named.

In the drawings, A is the frame; B, the vertically-grooved needle-cylinder; C, the revolving or cam cylinder; D, the yarn-carrier, secured to the shifting thread-carrier ring *d*; and E, the spool or bobbin frame or stand, shown in this instance as secured to and carried by the yarn-carrier, so that these two devices always occupy the same relative position toward each other under all conditions, as distinguished from the usual construction, in which the spool is on a stationary part of the frame, while the carrier revolves, and consequently, at every revolution, recedes from and approaches it.

By my present construction it will be seen that no take-up device of any sort is needed, and there can be no undue delivery of yarn, no slack thread in the way to do damage, and no tangling of the yarn, especially if more spools than one be used, while the tension of the yarn remains as nearly as may be uniform, thus producing better work. The spool-frame may be secured to the revolving cylinder or to the thread-carrier ring, instead of to the carrier itself, if desired.

F is an arm fastened removably or otherwise to the cam-cylinder, for driving the machine by hand without the use of any gearing, as will presently be described, although I have, for convenience, illustrated a machine having also thereon the customary gearing, as I prefer to build the machines so that they may be driven either way at option, though the gearing may be entirely dispensed with. A loose handle, G, on this arm serves for convenience in driving the machine. The cam-cylinder rests snugly in or on an annular bed on the frame A, so as readily and noiselessly to be revolved thereon. It will now be seen that with this construction and mode of driving, the usual crank and the driving-gear-wheel and its frame, the opening in the main frame to admit a part of such gear, and the circular series of gear-teeth on the main frame, may all, if desired, be dispensed with, thus bringing a family machine down to a simpler form, it is believed, than was ever yet done. Instead of making the arm F in a single rigid piece, as shown, it may be made jointed or hinged, so that when not in use it may be folded down out of the way. This handle does not in any way impede the work or the play of the needles, nor can it come in contact with the yarn, as it might do if my spool-frame were stationary. The handle may be placed in any desired position on the cylinder, as well as in the position shown. I sometimes place the handle immediately back of the thread-carrier, or attach them together in that relative position, so that in reversing the movement of the machine it shall swing in a portion of an arc, and shift or change the cams or switches. I may here remark that if the needle-cylinder, instead of the cam-cylinder, should be revolved, then the driving-handle would, of course, be affixed thereon. The cam-switches or wing-cams are shown at H H′, and it will be seen that they are so located as always to be below the lowest point of the needle, and not, as customary, on the upper side of the cam-groove. This or these wing-cams are located in the lower edge of the cam-groove or needle-rest, or directly below it, and are pivoted, jointed, or hinged to

the yoke Y, or lower section of the cam or part that forms the needle-guide, below the stitch or draw-down cams, so that in turning the machine the end or face *s* of the wing-cam is presented to the action of the butts of the needles, so that they will exert a lifting force upon it, and this force alone, or it in connection with the frictional contact of the butt upon such face, will raise the wing-cam to its full height, and thus throw up the needle to free the latch. The moment the machine is started or reversed in the opposite direction, this force being taken off, and the wing-cam relieved of it, the latter will naturally fall back to place; but if it should fail to do so, the side *t* of this cam occupies such a position that a number of needle-butts bearing on it at the same period of time will, by their united force and weight, carry it back to place. Persons skilled in the art will readily perceive that these wing-cams can also be made automatic by applying a spring under or to them, as at K, and serving to completely lift them, or to assist the friction exerted by the needles in lifting them. The screw I, as shown, works in an arched or curved slot, *i*, and this screw can be used to fasten the cam up or down when required. These wing-cams throw the needles up the whole distance required, being always below the groove or the butts of the needles. The outer parts *u' u'* of the guides U are for guiding the needles down, so that they will act properly on the wing-cams, and their inner parts *u u* guide the needles down onto the switch-cam K. The outer ends *u' u'* may be made larger or smaller, as circumstances may require.

It is very desirable, when a machine is stopped, especially if unfinished work be left upon it, that it shall not be meddled with by officious or inexperienced persons, and the work damaged or ruined. Now, by the construction shown, it will be seen that on stopping the machine, if both switches H H', by means of the adjusting thumb-screws I I', be lowered to their lowest position, then no meddler who may put the machine in motion can do any damage thereby to the knitted fabric, because the needles will not be raised high enough by the switch-cam to free the latch and throw off the loop. When the lower wall of the cam-groove is permanent and unchangeable, as in the most ordinary construction, or when the switches are above instead of below, it will be seen that the needles must inevitably, at each revolution, rise to the height to which such wall or switches compel them, and that it is impossible to avoid the freeing of the latch, the lift of the latch, and the throwing off of the loop. With the construction herein shown, the machine absolutely refuses to take a stitch until the intelligent operator who has stopped work, and lowered the switches, shall afterward raise them to resume again. Another advantage due to this feature is as follows: When making continuous tubing by revolving in one direction only, the rear cam can be swung down out of operation, and thus the unnecessary wear of the parts and useless rising and falling and wear of the needles, and flying up of the latch, and improper throwing off the stitch, can be avoided. Upon putting down both cams, an almost endless variety of novel fancy stitches and fabrics may be formed by simply raising certain needles, (by hand or otherwise,) so as to bring them into action for the moment, and then letting them drop out of action again. These cams may be automatic by simply putting a spring under them to press them upward. In going one way, (forward,) the forward cam would be pressed upward into position by the lifting friction of the butt of the needle, assisted by the spring; but the back cam, as the needles, (more in number,) pass over it, would be by them pressed down, so that the latch would not be freed. K is a vertically-adjustable cam-plate for lengthening or shortening the stitch, controlled as to position by the thumb-screw L, a pointer, *l*, moving therewith, and a short scale, *m*, on the cam-cylinder indicating to the eye externally the degree of such adjustment. N N are the usual fixed pieces on the cam-cylinder, acting in connection with pins *n n* on the frame to shift the thread-carrier to the opposite side of the cams on reversing the motion, that the thread may be in advance of the rising and falling needles. O is the clasp-ring, the inner edge of which fits into the annular groove of the needle-cylinder, as in one of my former patents. It is hinged at its center, as customary, and held by a spring-piece and pin, *p q*. On the upper surface of this clasp-ring I make a scale extending about half-way around, as shown. I have shown it divided into a hundred parts, subdivided into fives, tens, &c. On the angular outer edge of this ring I make a corresponding number of notches, and on the non-revolving cylinder may be placed a spring or click, or equivalent device, which, by means of a pin on the revolving cylinder, shall, at each revolution thereof, be struck and actuated, so as to move forward one notch on the edge of the ring, thus registering each revolution and each course of knitting. The ring should, for this purpose, be so held to one of the cylinders, by friction or otherwise, as not to move.

I claim—

1. The wing or switch cams H H', adapted to rise and fall at their outer ends, substantially as and for the purpose set forth, in combination with a stitch or draw-down cam and the needle-cylinder.

2. The wing-cams actuated by springs, in combination with guides *u u*, which serve to guide the needles to the draw-down cam, substantially as shown and described.

3. The wing-cams, adapted to be actuated by the butts of the needles, in combination with guides *u' u'*, needle-cylinder, and cam-plate.

4. A rotary knitting-machine resting on a smooth bed in its frame, provided with a driving-handle, as described, and with a shifting thread-guide and spool-carrier, which automatically, upon reversing the machine properly, change their position relatively to the needle-operating cams.

5. In combination with the rotary reversible cylinder of a family knitting-machine, a bobbin or spool frame or stand and a thread-guide, substantially as described, the combination being such that such frame or stand shall revolve coincidently with it and with the thread-guide, and upon reversing shall properly shift its position with the thread-guide.

DANA BICKFORD.

Witnesses:
W. BRADFORD,
RD. A. HYDE.